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Internal Rebellions and External Threats: A Model of Government Organizational Forms in Ancient China

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In ancient China, a ruler needed to handle both internal rebellions and external threats. To decrease the possibility of internal rebellions, a ruler could organize the government to establish the division of power among ministers. While effective in preventing internal rebellions, this approach could make the defense of the country against external threats less effective. The trade-off between preventing internal rebellions and dealing with external threats in a ruler's choice of government organizational form is affected by factors such as the size of the population, the level of coordination efficiency, and the degree of increasing returns to the military sector. If the magnitude of external threats increases, regardless of the type of equilibrium organizational form, the equilibrium level of the concentration of power among division heads increases.

JEL Classification: N15, N45, P40

1. Introduction

In ancient China, to continue his reign, a ruler needed to prevent and put down internal rebellions and deal effectively with external threats.[1] Internal rebellions were frequently observed in China's history, as recorded in Sima (1988) and Sima et al. (1984). A general might rebel, a high ranking civilian officer might usurp power, and peasants might rebel. External threats were also common in China's history. For example, in the early stage of the Han Dynasty (206 BC–220), the threat from Xiongnu was severe.[2] More significantly, the Song Dynasty (960–1279) was replaced by the invading Mongols, and the Ming Dynasty (1368–1644) was replaced by the invading Manchu.

To prevent internal rebellions and to deal with external threats, a ruler may choose from three types of government organizational forms.[3] First, the ruler might adopt the feudalism

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[1] Internal rebellions and external threats frequently interacted with each other. On the one hand, internal rebellions could encourage external invasions. For example, the rebellions of the kings in the Western Jin Dynasty (265–316) contributed to the invasion of nomadic groups. On the other hand, external threats could exacerbate internal rebellions. For example, when Li Yuan was the leader of an army of the Sui Dynasty (581–618) stationed in Taiyuan to cope with external threats from the Turks, he used the possibility of an imminent Turkish attack to justify his action to recruit additional soldiers. With a large number of soldiers under his control, Li Yuan rebelled against the Sui government and became the founding emperor of the Tang Dynasty (618–907).

[2] For the dates of dynasties, if not explicitly specified, they should be interpreted as AD.

[3] One alternative way to decrease the possibility of internal rebellions was to put "good" individuals less likely to rebel into important positions, as emphasized by the Confucianism school. A famous example of the success of this approach was the Duke of Zhou in the Zhou Dynasty (1045–256 BC). The Duke of Zhou had the power to punish the ruler for the ruler's wrong doing while he did not usurp the power of the ruler (Huang 1997).

(*fengjian*) form.[4] Under this organizational form, kingdoms were established. Important positions of the country would be inherited and would not be controlled by the central government, and the power of the central government would be limited. Second, the ruler may adopt the commandery-county (*jun-xian*) organizational form. For simplicity of presentation, for the rest of this article, this organizational form is referred to as the county form. Under the county form, local officials would be appointed by the central government and administrative power would be concentrated at the central government.[5] Although the county form would be useful to pool resources for the central government and might make the handling of external threats more effective, internal rebellions could be a threat to the ruler because a minister's control of the central government would lead to the usurpation of power. Third, the ruler might adopt a mixed organizational form in which some parts of the country were organized as kingdoms and other parts of the country were organized as counties.

As discussed in more detail in section 2, within a given government organizational form, a ruler could take various measures to decrease the possibility of internal rebellions. Those measures worked by decreasing the concentration of power among ministers. But the decentralization of power means that organizational efficiency could be harmed and the handling of external threats would be less effective. That is, although an institution could decrease the possibility of internal rebellions, at the same time it could make defense against external threats less effective.

Scholars in China have long debated the choice of organizational form, going back to the Qin Dynasty (221–206 BC) more than 2000 years ago. Each type of organizational form has its pros and cons. Under the county form, without kingdoms established, powerful ministers could usurp power. Under the feudal form, when kingdoms were established, the existence of kingdoms could deter powerful ministers from usurping power. However, kings might rebel and fight among themselves. Although no organizational form proved suitable for various situations, historically a ruler's choice of government organizational form was not random and was affected by factors such as the size of the population, the magnitude of external threats, the level of coordination efficiency, and the degree of returns to scale in the military. For example, the choice of organizational form could be affected by the degree of returns to the military sector. If an organizational form leads to multiple small armies rather than one large army, the possibility of internal rebellions by a military leader would be smaller, but the aggregate military strength of the country, and hence the ability of this country to defend against external threats, would be sacrificed with increasing returns to the military sector.

The literature includes numerous valuable studies on ancient China. For example, Huang (1974) addresses taxation and governmental revenue in the Ming Dynasty. Chao (1986) examines the evolution of land-labor ratio in ancient China. Shiue (2002), Keller and Shiue (2007), and Shiue and Keller (2007) study the degree of market integration in the Qing Dynasty (1644–1911) and compare it with that of Europe. Lin (1995), Wong (1997), Pomeranz (2000), and Rosenthal and Wong (2011) address the absorbing question of ancient China's lack of industrialization. Lin (1995) argues that lack of competition harmed technological development in ancient China. Wong (1997) argues that it could be more difficult to explain the divergence

[4] The term "feudalism" used in the study of European history is frequently used to refer to dynasties in China after the Qin Dynasty. However, there were significant differences between European feudalism and the Chinese dynasties (Huang 1999, pp. 146–7).

[5] In China's history, a dynasty could be commonly viewed as organized as a county form, even though remote regions might be organized as highly autonomous units.

between China and Europe once it is recognized that many factors believed to have contributed to Europe's industrialization were also present in China. Pomeranz (2000) argues that the use of coal and the opening of trade with the New World in Europe and the lack of those in China could be used to explain the divergence between China and Europe. Rosenthal and Wong (2011) argue that competition among political powers might be necessary but not sufficient to explain a region's industrialization because competition among political powers led to external wars that could be very costly.

However, to my best knowledge, there is no formal model addressing the choice of government organizational form in ancient China. In this article, I study a ruler's choice of organizational form in ancient China in a simple formal model to provide a framework to organize the thinking on this important issue. In the model, a ruler chooses the organizational form to maximize his expected benefit.[6] Both the feudalism form and the county form have their advantages and disadvantages. Although the feudalism form needs less coordination among different divisions of the government, it is not as good at exploiting increasing returns to the military sector. Although the county form might exploit increasing returns to the military sector better, with the division of power established endogenously within the county form, it could suffer from a lack of coordination among different divisions of the government. If the degree of increasing returns to the military sector is small or if the level of coordination efficiency is low, the ruler will choose the feudal organizational form. Conversely, if the degree of increasing returns to the military sector is high or the level of coordination efficiency is high, the ruler will choose the county form.

If the magnitude of external threats increases, the result is robust, showing that, regardless of the equilibrium type of organizational form, the equilibrium number of divisions decreases and thus the degree of concentration of power among division heads increases. With a higher degree of concentration of power among division heads, the possibility of internal rebellions by a division head could increase.

This article contributes to the literature by analyzing the effect of internal rebellions and external threats on a ruler's choice of government organizational form in a unified model rather than treating the effect of internal rebellions and the effect of external threats separately. This unified framework is useful in explaining some historical puzzles. For example, one puzzle in China's history is that, compared with other dynasties such as the Tang Dynasty, the Song Dynasty was richer while militarily weaker (Elvin 1973). Why did the wealth of the Song Dynasty not translate into a stronger military force? This puzzle can be explained using the unified framework: To develop a strong army, a concentration of military resources would be needed. But this concentration of military resources would increase the possibility of a rebellion by a military leader and might not be adopted. Because policies to develop a strong army were not adopted, the wealth of the Song Dynasty did not turn into military power. This model is also useful in explaining why the rulers in ancient China tried to disarm the country after a unification of the country rather than maintain a strong army: Recognizing that a strong army might be used not only to deal with external threats but also be used by ministers to rebel, rulers frequently chose to disarm.

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[6] Davis (2003) studies organizations from a transaction cost perspective. Zhou (2005) studies how the relative performance of the unitary organizational form and the multidivisional organizational form is affected by market structure, such as the number of firms competing in the same industry.

When a ruler designed the institutions for his dynasty, he could be mainly concerned with his and his family's rule rather than economic efficiency. Many institutions designed by rulers actually harmed economic efficiency.[7] For example, Huang (1999) argues that various institutions designed by Zhu Yuanzhang (the founding emperor of the Ming Dynasty) were not based on efficiency considerations. From this perspective, this model provides a reason for the persistence of inefficient institutions: Although division of power within the government might be inefficient from an economic efficiency perspective, it is useful to the ruler because it could decrease the possibility of internal rebellions. That is, the multiple roles played by an institution make an economically inefficient institution persistent.

This study focuses on the choice of organizational form in China. Compared with Europe, there are some similarities and differences. On the one hand, the preparation of external wars led to a consolidation of power and strengthening of the central government in both China and Europe. In China, during the Spring Autumn Period (770–476 BC) and the Warring States Period (475–221 BC), political powers fought to annex each other. The number of kingdoms decreased over time as consolidation of power went on. Also, the preparation of war with Xiongnu in the Han Dynasty under the rule of Liu Che led to a strengthening of the central government. In Europe, as discussed in Tilly (1992) and Rosenthal and Wong (2011), preparation of external wars also had a significant effect in Europe. The growth of military technologies has played an important role in driving state formation in Europe. Military technology changed how war was conducted (Parker 1996). Compared with national states, the small-scale and fragmented sovereignty of city-states was a clear disadvantage. The city-state and city-empire lost out when mass armies recruited from the state's own population became crucial to successful warfare (Tilly 1992). On the other hand, external war threats were more significant in Europe than in China (Rosenthal and Wong 2011). This difference led to differences in the location of industries between ancient China and Europe. In China, during the Ming and Qing Dynasties, because the external war threats were usually not significant, hand-craft industries were frequently located at rural areas to be close to raw materials, to save labor costs, and to avoid the high mortality rate in cities. In Europe, because the war threat was significant, industries were concentrated in walled cities for protection and cheap capital. Because the cost of labor was relatively high in cities, this facilitated the development of machines in Europe. To raise the huge amounts of money for external wars, rulers in Europe encouraged the creation of credit markets. Competition among political units in Europe led to technological development embodied in machines and the development of institutions such as financial institutions and eventually led to the unintended consequence of European industrialization (Rosenthal and Wong 2011).

In this model, a ruler's choice of organizational form is affected by various parameters. One interesting question is to posit a reason for the change in parameters that produced the changing organizational forms. In the literature, various mechanisms induce parameter changes. First, in Jones (2001) and Zhou (2009), population growth serves as the mechanism of changing behavior. In Galor and Weil (2000), population density forces changes. Second, in Tamura (1996a, 1996b, 2002, 2006), human capital accumulation can induce changing costs of organization and hence changing organizational form. In this model, the size of the population is also a key parameter. Other parameters in this model, such as the degree of returns to the

[7] See Davis (2008) and Hall, Sobel, and Crowley (2010) for recent studies of the role of institutions on economic performance.

military sector, can be affected by population change and human capital accumulation and interact with them.

The rest of the article is organized as follows. Section 2 illustrates the organizational responses to internal rebellions and external threats in ancient China to motivate the model. Section 3 specifies the model and establishes the equilibrium conditions. Section 4 studies the equilibrium organizational form. Section 5 presents numerical results on the effect of parameter changes on the optimal choice of organizational form. Section 6 relates historical evidence on the choice of organizational form to results in this model. Section 7 discusses some generalizations and extensions of the model and concludes.

2. Organizational Responses to Internal Rebellions and External Threats in Ancient China

Historically, a ruler's choice of government organizational form in ancient China was complicated and affected by various factors. For example, a ruler might establish some kingdoms to reward surrounded generals, such as the kingdoms established in the early period of the Qing Dynasty to reward generals from the Ming Dynasty. Even though various factors affected a ruler's choice of government organizational form, his concern for preventing internal rebellions and dealing with external threats was significant.[8] For example, the concern for preventing internal rebellions and dealing with external threats was dominant when Zhu Yuanzhang designed the political system in the Ming Dynasty. In this section, I illustrate the organizational responses to internal rebellions and external threats in ancient China.

In China's history, first, the organizational form adopted in the Zhou Dynasty was close to feudalism. Rulers of the Zhou Dynasty established many kingdoms to reward their relatives and subordinates and to place nobles from the replaced Shang Dynasty. The central government was weak under the feudal system and the Zhou ruling house was more like a nominal leader rather than a real leader of the kingdoms. Second, during the Spring Autumn Period and the Warring States Period, kingdoms fought with each other for survival. A king's direct control of resources was important for his success in fighting. To increase military strength, when a kingdom acquired a new piece of land, this piece of land could be organized as a county ruled directly by the king rather than as an autonomous unit awarded to a Dafu ruled indirectly by the king.[9] In this sense, the rise of counties could be viewed as an organizational innovation.[10] Examples of the county organizational form include the Qin Dynasty and the Tang Dynasty. For the county form, because power was concentrated at the central government, if a powerful minister was able to control the central government he could usurp

[8] In ancient China, the ruler's concern for preventing internal rebellions and dealing with external threats was also important when the location of the capital was chosen.

[9] Here, kings in the Warring States period would either set up counties or autonomous units. In other parts of this article, "kingdom" becomes synonymous with the autonomous unit. A reader might want to be aware of the following fact in China's history to avoid being confused. Qi Shi-huang-di (259–210 BC) at the end of the Warring States period was the first emperor in China. Before him, the highest ruler would be called the king. After him, the highest ruler would be called the emperor instead of the king.

[10] The establishment of counties was an important part of the famous Shang Yang Reform. This reform laid the institutional foundations for Qin to unite China.

the government. Third, examples of the mixed organizational form include the early stages of the Han Dynasty, the Western Jin Dynasty, and the Ming Dynasty.

No organizational form had a perfect record in preventing internal rebellions. In the feudalism form during the Zhou Dynasty, the authority of the Zhou ruling house declined gradually and kingdoms engaged in fighting among themselves. The Zhou ruling house was eventually eliminated by the kingdom Qin. In the county form during the Han Dynasty, Wang Mang, a relative of the royal family, usurped the central government, and during the Three Kingdoms Period (220-280), when the ruler from the Cao family was young, Sima Yi usurped power through a military coup. The three dynasties that adopted the mixed organizational form all suffered from the rebellions of kingdoms as well. In the Han Dynasty, several kingdoms engaged in a rebellion in 154 BC; in the Western Jin Dynasty, eight kingdoms engaged in wars that lasted from 291 to 306; in the Ming Dynasty, the second emperor Zhu Yunwen was overthrown by the rebelling king Zhu Di (Zhu Yunwen's uncle) after a war that lasted from 1399 to 1402. Zhu Di became the third emperor of the Ming Dynasty.

Within each type of organizational form, a ruler could take various measures to decrease the possibility of internal rebellions. Balance of power was attempted between the kingdoms and counties. For example, in the Han Dynasty, the domains of the kingdoms intersected with the domains of the counties so that they could monitor one another. To decrease the possibility of the rebellions of kingdoms, Liu Che, an emperor in the Han Dynasty, changed the law on inheritance of the kingdoms. Before his change of the law, only one offspring (usually the oldest son) of a king could inherit the kingdom, and the size of a kingdom would not change over time. After Liu Che's change of the law, the central government required every son of a king to be granted the right to inherit a part of the kingdom. Since a king in ancient China usually had multiple wives and thus multiple sons, a kingdom would be divided into several smaller kingdoms after the death of the incumbent king. The size of a kingdom would decrease and the threat of a kingdom to the central government would decrease over time.

Under the county form, to decrease the possibility of usurpation of power by civilian officers, rulers established the division of power within governments. For the organization of the central government, the three "departments" (*sheng*) of the central government of the Sui Dynasty (589–618) and the Tang Dynasty had balance of power among them in the following way. The Zhongshu Sheng was responsible for drafting an order, the Mengxia Sheng was responsible for reviewing the order, and the Shangshu Sheng was responsible for implementing the order. The Shangshu Sheng was further divided into six "ministries" (*bu*) specializing in personnel administration, finance, rites, military, justice, and public works, respectively. There was also division of power in the organization of local governments.[11] For example, in the Qing Dynasty before the Taiping Rebellion (1851–1864), the official in a province supervising the army would be different from the official collecting government revenues.[12] Without enough revenue to reward his subordinates, it would be difficult for the official supervising the army to

[11] In the Yuan, Ming, and Qing Dynasties, the borders of some provinces did not follow the natural boundaries defined by rivers and mountains. Instead, to prevent local power from arising, the ruler defined the borders of provinces in such a way so that provinces were not relatively self-sufficient.

[12] During the war to put down the Taiping Rebellion, to improve coordination efficiency, officials leading an army, such as Zeng Guofan, were frequently granted the right to collect tax, supervise officials collecting taxes, or both. This increase in the power of local officials at the province level planted the seed of the collapse of the Qing Dynasty. Later on, during the Boxer movement in 1900, officials from provinces in southeastern China chose not to follow the central government's order to declare war on foreign governments. During the revolution in 1911, when provinces disobeyed the order of the central government, the Qing Dynasty ended.

recruit enough dedicated followers among his subordinates and thus to rebel. In China's history, such as during the Han Dynasty, the central government also frequently sent out officials to monitor local government officials.

Under the county form, a prime minister occupied an important position and could be a challenge to the emperor. In China's history, as the emperors tried to consolidate power, the power of a prime minister decreased over time (Qian 2001). Early on, in the Qin Dynasty (the first dynasty to establish central government rule in ancient China) and the early stage of the Han Dynasty, a prime minister was responsible for running the government and had significant power. For example, the prime minister Li Si played an important though infamous role in deciding who would be the next emperor after the death of the emperor Qin Shi-huang-di. Meanwhile, the emperor Liu Che of the Han Dynasty adopted a strategy of using junior officials rather than well-established officials as prime ministers because junior officials would not have the authority to challenge him. Liu Che also used his own office rather than the prime minister's office to implement some government orders. In the Tang Dynasty, the heads of the three "sheng" were prime ministers. Thus there were multiple prime ministers and the power of a prime minister in the Tang Dynasty was smaller than that in the Han Dynasty. Later on, in the Ming Dynasty, the founding emperor Zhu Yuanzhang used the rebellion of the prime minister Hu Weiyong as an excuse to take an extreme measure of eliminating the position of the prime minister altogether. Sacrificing coordination efficiency, Zhu Yuanzhang distributed the power of the prime minister to lower ranking officials (heads of the six *bu*). The Qing Dynasty (the last dynasty of China) adopted many institutions of the Ming Dynasty, and there was no prime minister in the Qing Dynasty.

Rulers took specific measures to decrease the possibility of rebellions by military officers.[13] In various cases, the central government tried to support multiple military leaders so that they could deter one another from rebelling rather than to concentrate resources on one military leader. For example, in the Qing Dynasty, Zeng Guofan was leading an army to put down the Taiping Rebellion. As the emperor at that time was a child, Empress Dowager Cixi was the actual ruler of the government. Cixi was worrying about a potential rebellion of Zeng because Zeng had the largest army in the country at that time. To decrease the risk of a potential rebellion of Zeng, Cixi tried to provide more resources to Zeng's colleagues rather than Zeng, even though this strategy could make fighting with the Taiping army less effective.

A systematic approach to prevent rebellions of military leaders was pursued by Zhao Kuangyin, the founding emperor of the Song Dynasty. Before becoming the emperor, Zhao was a high ranking military officer of Chai Yong, the incumbent emperor of the Later Zhou Dynasty (951–960). After Chai Yong's death, his son Chai Zongxun, who was only seven years old, became the new emperor. During this transition of power, it was claimed that there was an invasion and the central government sent Zhao to fight the enemies; Zhao's subordinates initiated a coup, and Zhao was installed as the new emperor. Based on his own experience and the lessons learned from previous dynasties, such as the rebellion of An Lushan in the Tang Dynasty, Zhao created a system of the balance of power within the army to decrease the possibility of rebellions by military leaders. Under Zhao's system, first, there was balance of power between armies stationed in the capital and armies stationed at local governments: Armies stationed in the capital were strong enough to put down any rebellion from an army stationed in a local government, and armies stationed at local governments together could put

[13] Qian (2001) provides a discussion of the military institutions in the Han, Tang, Song, and Ming Dynasties.

down a rebellion from the armies stationed in the capital. Second, some important military positions, such as Zhao's former position in the military were eliminated. For each remaining important position, it could be split into several positions so that the role of one individual would not be too significant. Third, to prevent personal attachment between generals and soldiers, the generals training soldiers would be different from the generals leading soldiers in fighting. In a military campaign, it was common that generals were not familiar with their soldiers and soldiers were not familiar with the generals who were leading them.

Measures used to decrease the possibility of internal rebellions could make the handling of external threats less effective, and vice versa. The conflict between preventing internal rebellions and dealing with external threats was common in ancient China. On the one hand, measures to deal with external threats could increase the possibility of internal rebellions. The change of the military recruitment system in the Tang Dynasty provides an example of this type of conflict. Before the emperor Li Longji, the Tang Dynasty rotated soldiers who were also peasants for military services.[14] To deal with external threats more effectively, Li Longji adopted a policy that changed the compulsory military recruitment system to a voluntary system in which soldiers became professionals. While the handling of external threats was successful, this change led to the rise of powerful generals, such as An Lushan. The rebellion of An Lushan and Shi Siming led to a civil war that lasted for several years. Even though the rebellion was eventually put down, it led to the decline and finally the collapse of the Tang Dynasty.

On the other hand, measures to decrease the possibility of internal rebellions could make the handling of external threats less effective.[15] For the Song Dynasty, while the institutions were effective in preventing internal rebellions from happening, the Song government was defeated and replaced by the Mongols, even though the Song Dynasty was more developed than its enemies (Elvin 1973, chap. 7).[16] For example, the prevention of personal attachment between generals and soldiers decreased the possibility of rebellions by generals, but it also decreased the military strength of the army.[17] Also, to prevent internal rebellions, the Song government absorbed many peasants without land and criminals into the army, and this type of practice decreased the fighting power of the army.[18]

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[14] Elvin (1973, chap. 5) has a discussion of the recruitment of soldiers in the Tang Dynasty. The rotary system depended on a relatively equal distribution of land. As the distribution of land became less equal over time and many peasants lost their land, the rotary system was not functioning because not many peasants could afford the expenses any more.

[15] To prevent the generals from rebelling, rulers frequently sent out their personal representatives (usually eunuchs) to monitor the generals. Because those personal representatives normally did not have much expertise on how to fight wars, their decisions frequently decreased the effectiveness of military officers and thus the handling of external threats.

[16] Interestingly, the Song Dynasty lasted for more than three hundred years and was the longest dynasty in China since 221 BC. In this sense, the strategies adopted by the founding emperor Zhao Kuangyin to preserve the dynasty were successful.

[17] In China's history, successful military leaders such as Yue Fei in the Song Dynasty, Qi Jiguang in the Ming Dynasty (Huang 1982, chap. 6), and Zeng Guofan in the Qing Dynasty depended on their personal attachment with soldiers for their achievement. For example, Zeng recruited soldiers from the same region from which he came, and the generals of Zeng's army were relatives, students, and friends of Zeng. In Zeng's army, a general was responsible for recruiting his subordinates and if the leader of a division was killed during a war, the whole division would be disbanded. This policy strengthened soldiers' attachment with their leaders. Because soldiers came from the same hometown and were well connected with one another, they were more likely to help one another in the battlefield rather than escape from their wounded colleagues because of personal attachment, and fleeing soldiers would carry the stigma of desertion not only in the army, but also in their hometowns.

[18] To prevent peasants without enough food from rebelling, governments frequently organized relief activities. See Shiue (2004, 2005) for famine and disaster relief in the Qing Dynasty.

As the magnitude of external threats and the possibility of internal rebellions changed over time, a ruler's policy could change over time, even dramatically. For example, in the Song Dynasty, when the magnitude of external threats from the Western Xia (1038–1227) was severe, an official named Fan Zhongyan initiated a reform in 1043 to deal with this external threat. This reform included measures such as the establishment of a professional army so that generals would be familiar with the soldiers, the elimination of redundant officials in the government, and an increase in the power of the prime minister. Fan's reform was initially supported by the emperor Zhao Zhen. However, when a peace treaty was signed between the Song government and the Western Xia government and the degree of external threats decreased, the concern for internal rebellions increased. Some officials in the Song government suggested to the emperor Zhao Zhen that Fan's policies were dangerous to the emperor's rule and Zhao Zhen demoted Fan Zhongyan. Because Fan was a highly regarded official in China's history, in popular books, the demotion of Fan was attributed to the criticisms of his "bad" colleagues to highlight the conflicts between good ministers and bad ministers. The unified framework in this model suggests that it was the change of the fundamentals affecting the relative importance of dealing with external threats and preventing internal rebellions that determined the rise and fall of Fan.

3. Model Specification

In this section, I specify the model and establish conditions for equilibrium. The population of the country is L, which is exogenously given. The ruler chooses the number of kingdoms and the number of counties to maximize his expected benefit, which is affected by the possibility of internal rebellions and the existence of external threats. First, if the ruler only establishes kingdoms in equilibrium, the organizational form is called the feudalism form. Second, if the ruler only establishes counties in equilibrium, the organizational form is called the county form. Third, if the ruler establishes both kingdoms and counties in equilibrium, the organizational form is called the mixed form. The ruler engages in a tournament with a "foreign" ruler and the military strength of the foreign ruler measures the magnitude of external threats. If the ruler wins the tournament with the foreign ruler and there is no successful internal rebellion, the ruler gets an exogenously given reward. To simplify notation, this reward is normalized to 1. If either the ruler loses the tournament with the foreign ruler or if there is any successful internal rebellion, for simplicity, the ruler gets a reward of 0. When the level of military strength of the ruler is Ψ and the level of military strength of the foreign ruler is Ω, the ruler's probability of winning the tournament is specified as $\Psi/(\Psi + \Omega)$.[19]

The military strength of the foreign ruler is assumed to be exogenously given.[20] The military strength of the ruler is affected by factors such as the level of domestic population and his choice of organizational form. Suppose in equilibrium, the ruler establishes m kingdoms,

[19] This specification of the determination of the winner follows rent-seeking models in the literature. The specification of the determination of the winner could be different in research and development tournaments, as studied in Zhou (2006).

[20] This assumption can be motivated as follows. In a traditional society, the military strengths of nomadic groups were affected by various types of uncertainties, such as the amount of snow, which could affect the quantities of live stock, such as the number of horses, and thus the military power of the nomadic groups.

$m \geq 0$, and n counties, $n \geq 0$.[21] To simplify presentation, the numbers of kingdoms and counties are real numbers, rather than being restricted to integers. The sum of the number of kingdoms and the number of counties is referred to as the number of divisions in the government. Thus the total number of divisions in the government is $m + n$. All divisions are assumed to have the same population size l. The sum of the population in all divisions is equal to the total size of the population of the country:

$$(m+n)l = L. \tag{1}$$

When the ruler chooses the number of divisions, his decision is affected by the level of coordination efficiency and the degree of increasing returns to the military sector. If the ruler establishes counties, these counties need to be coordinated. For $0 \leq c \leq 1$, c measures the level of coordination efficiency among the counties, and a higher value of c indicates a higher level of coordination efficiency. With n counties, the aggregate level of coordination efficiency among all counties is specified as c^n. That is, other things equal, a greater number of counties decreases the aggregate level of coordination efficiency among the counties.

The degree of returns to scale in the military sector is s. When there are decreasing degrees of returns to the military sector, the feudalism form will always dominate. That would not be very interesting. To focus on the interesting case, I study the increasing returns case that $s \geq 1$. Increasing returns to the military sector can be motivated as follows. In ancient China, complicated technologies to attack cities and to defend cities were developed. A large army would be conducive in applying these military technologies. A higher number of soldiers allows a better division of labor among soldiers and this can make military operations more effective.

With increasing returns to the military sector, will the ruler choose as few divisions as possible to exploit increasing returns? Not necessarily. When the number of divisions of the government is small, a division head has significant power and may rebel. When the total number of divisions increases, power becomes less concentrated among division heads and the probability of successful rebellion by a division head decreases. If a division head's probability of a successful rebellion decreases at a rate faster than the rate of the increase in the total number of divisions, the total probability of a successful rebellion by any divisional head decreases with the total number of divisions. This claim can be motivated as follows. When there are $m + n$ divisions, if a division head decides to rebel, the division members will consider the possibility of the success of the rebellion before following the division head's decision to rebel. It is reasonable to assume that division members are less likely to follow their division head when their division head controls a smaller percentage of the military force in the country. The percentage of the military force controlled by a division head is $1/(m + n)$. For simplicity, suppose the possibility that division members follow their division head to rebel with probability $1/(m + n)$. Even though the division members would follow their division head to rebel, to rebel successfully, this division head still needs to win the fight with other divisions. Conditional that his subordinates are willing to support him, suppose the probability that this rebelling division head wins the fight with other divisions is $1/(m + n)$. Thus, the probability that a division head is able to rebel successfully is $1/(m + n)^2$. Because there are $m + n$ divisions, if the probabilities of successful rebellions of divisions are independent, the total probability of any

[21] One alternative interpretation of n is the degree of the division of power among division heads of counties. With this interpretation, an increase in n means an increase in the division of power among division heads of counties.

successful rebellion by a division head is $1/(m + n)$. That is, the probability of no successful rebellion is $1 - 1/(m + n)$, and it increases if the total number of divisions increases.

Because the counties and the kingdoms are organized in different ways, increasing returns might not operate at the national level. Because kingdoms were relatively autonomous, increasing returns for a kingdom applied at the individual kingdom level. Each of the m kingdoms has a military strength of l_i^s, and military strength from all kingdoms is $\sum_{i=1}^{m} l_i^s$. Increasing returns for the counties apply at the size of the population organized under the counties. The size of the population under the counties is $L - ml$; taking into account the level of coordination efficiency, total military strength from counties is $c^n(L - ml)^s$. The total military strength of the ruler is the sum of the military strength from the kingdoms and the counties: $\Psi = \sum_{i=1}^{m} l_i^s + c^n(L - ml)^s$. Taking into account the probability of no successful rebellions, $1 - 1/(m + n)$, and the probability $\Psi/(\Psi + \Omega)$ of winning the tournament, the ruler's expected payoff is $\{1 - [1/(m + n)]\}\Psi/(\Psi + \Omega)$. Plugging in the value of Ψ, the expected payoff of the ruler can be expressed as

$$\left(1-\frac{1}{m+n}\right)\frac{\sum_{i=1}^{m} l_i^s + c^n(L-ml)^s}{\left(\sum_{i=1}^{m} l_i^s + c^n(L-ml)^s\right)+\Omega} = \left(1-\frac{l}{L}\right)\frac{c^n n^s + m}{c^n n^s + m + \Omega l^{-s}}. \tag{2}$$

When the ruler chooses the organizational form, there is a conflict between dealing with external threats and preventing internal rebellions. To deal with external threats, it is better to establish a small number of divisions to exploit increasing returns to the military sector. However, a small number of divisions will make internal rebellions more likely. By sacrificing some military power in dealing with the external threats, the probability of internal rebellions decreases. Overall, the expected payoff of the ruler could be higher.

In this model, I assume that it is impossible for the ruler to choose a pure county system with only one county. There were at least two reasons for this assumption. First, if a ruler led an army, the repercussion of a defeat could be much larger than a defeat led by someone else. Under normal circumstances, the bureaucracy would oppose the ruler from leading an army.[22] Thus it was not strange that Li Shimin of the Tang Dynasty was directly involved in leading military campaigns before he became the emperor, whereas he was much less directly involved in leading military campaigns after he became the emperor. Second, it might not be feasible for the ruler to lead an army. After the death of a ruler, the new ruler could be very young and would not be able to head an army. Since the founding rulers established institutions to help their offspring rule as long as possible, it would be better to have an institution that would work under different situations, such as a young ruler, a not very competent ruler, or both. With the above two justifications, I assume that the ruler would not establish only one division for the country and be the head of only this division.

By choosing the number of kingdoms, the number of counties, and the size of each division, the ruler tries to maximize Equation 2, subject to Constraint 1 and the constraints that

[22] Interestingly, in the Ming Dynasty, the emperor Zhu Houzhao did a very unusual thing by awarding himself a title of grand general so that he could circumvent the opposition of the bureaucracy to lead an army (Huang 1982). Zhu's behavior was a headache to the government bureaucracy.

the number of divisions should be nonnegative.[23] For costate variables λ_1, λ_2, and λ_3, the Lagrangian is

$$\underset{m,n,l}{\text{Max}}: \left(1-\frac{l}{L}\right)\frac{(c^n n^s+m)}{c^n n^s+m+\Omega l^{-s}}+\lambda_1[L-(m+n)l)]+\lambda_2 m+\lambda_3 n.$$

One can arrive at the following results by applying the envelope theorem on the above objective function. First, the expected payoff of the ruler increases with the size of the population. Thus an increase in the size of the population is beneficial to the ruler. Second, the expected payoff of the ruler decreases with the magnitude of external threats. Thus an increase in the magnitude of external threats is harmful to the ruler. Third, the expected payoff of the ruler increases with the level of coordination efficiency. Thus an increase in the level of coordination efficiency is beneficial to the ruler. Fourth, the expected payoff of the ruler increases with the degree of returns to the military sector. Thus an increase in the degree of returns to the military sector is beneficial to the ruler.

The first-order condition with respect to m is

$$\left(1-\frac{l}{L}\right)\frac{\Omega l^{-s}}{(c^n n^s+m+\Omega l^{-s})^2}-\lambda_1 l+\lambda_2\geq 0. \tag{3}$$

The first-order condition with respect to n is

$$\left(1-\frac{l}{L}\right)\frac{(sn^{s-1}c^n+n^s c^n\ln c)\Omega l^{-s}}{(c^n n^s+m+\Omega l^{-s})^2}-\lambda_1 l+\lambda_3\geq 0. \tag{4}$$

The first-order condition with respect to l is

$$s\left(1-\frac{l}{L}\right)\frac{(c^n n^s+m)\Omega l^{-s-1}}{(c^n n^s+m+\Omega l^{-s})^2}-\frac{1}{L}\frac{(c^n n^s+m)}{c^n n^s+m+\Omega l^{-s}}-\lambda_1(m+n)=0. \tag{5}$$

In addition to Equations 1, 3, 4, and 5, other necessary conditions for the ruler's optimization include

$$\lambda_2 m=0, \qquad \lambda_2\geq 0, \qquad m\geq 0,$$

$$\lambda_3 n=0, \qquad \lambda_3\geq 0, \qquad n\geq 0.$$

4. Equilibrium Organizational Form

Depending on the values of parameters such as the level of coordination efficiency, either a corner solution or an interior solution is possible. Two types of corner solutions are possible: One is the pure feudalism form in which the ruler only establishes kingdoms, and the other is the pure county form in which the ruler only establishes counties. One interior solution is

[23] If the sum of the number of kingdoms and counties was less than one, the possibility of internal rebellions would be greater than one. To rule out that case, the equilibrium number of kingdoms and counties should be greater than one. Whether this condition is satisfied or not can be checked once the values of parameters such as the size of the population are specified.

possible, in which the ruler establishes both kingdoms and counties in equilibrium. In the following, I first study the feudalism form, then the mixed organizational form, and finally the county form.

The Feudalism Organizational Form

In this subsection, I study the corner solution in which the government is organized in the pure feudal form. Under pure feudalism, $n = 0$.

From Equations 3 and 5, the number of kingdoms under the feudalism form is defined by

$$s-1-\frac{s}{m}-\frac{L^s}{m^s\Omega}=0. \tag{6}$$

Equation 6 has three implications. When the government is organized as the feudalism form, first, an increase in the size of the population increases the optimal number of kingdoms. Second, an increase in the magnitude of external threats decreases the optimal number of kingdoms. Third, an increase in the degree of increasing returns to the military sector decreases the number of kingdoms.

The Mixed Organizational Form

In this subsection, I study the mixed organizational form in which the ruler establishes both kingdoms and counties in equilibrium. With both kingdoms and counties, it is necessary that both $\lambda_2 = 0$ and $\lambda_3 = 0$. From Equations 1, 3, 4, and 5, one can derive the following system of three equations defining the variables m, n, and l as functions of exogenous parameters:[24]

$$V_1 \equiv L-(m+n)l=0, \tag{7a}$$

$$V_2 \equiv c^n n^{s-1}(s+n\ln c)-1=0, \tag{7b}$$

$$V_3 \equiv s(c^n n^s+m)-(m+n)-\frac{l^{s+1}(c^n n^s+m)(c^n n^s+m+\Omega l^{-s})}{\Omega(L-l)}=0. \tag{7c}$$

Partial differentiation of $V_1 - V_3$ with respect to m, n, l, L, Ω, c, and s leads to

$$\begin{pmatrix} \frac{\partial V_1}{\partial m} & \frac{\partial V_1}{\partial n} & \frac{\partial V_1}{\partial l} \\ 0 & \frac{\partial V_2}{\partial n} & 0 \\ \frac{\partial V_3}{\partial m} & \frac{\partial V_3}{\partial n} & \frac{\partial V_3}{\partial l} \end{pmatrix} \begin{pmatrix} dm \\ dn \\ dl \end{pmatrix} = -\begin{pmatrix} \frac{\partial V_1}{\partial L} \\ 0 \\ \frac{\partial V_3}{\partial L} \end{pmatrix} dL - \begin{pmatrix} 0 \\ 0 \\ \frac{\partial V_3}{\partial \Omega} \end{pmatrix} d\Omega - \begin{pmatrix} 0 \\ \frac{\partial V_2}{\partial c} \\ \frac{\partial V_3}{\partial c} \end{pmatrix} dc - \begin{pmatrix} 0 \\ \frac{\partial V_2}{\partial s} \\ \frac{\partial V_3}{\partial s} \end{pmatrix} ds. \tag{8}$$

The following proposition studies the effect of an increase in the size of the population on the ruler's choice of organizational form.

PROPOSITION 1. When the ruler chooses the mixed form, an increase in the size of the population leaves the number of counties unchanged while increasing the number of kingdoms.

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[24] Equations 7a, 7b, and 7c are derived as follows. First, Equation 7a is the same as Equation 1. Second, with $\lambda_2 = 0$ and $\lambda_3 = 0$, Equation 7b results from plugging the value of λ_1 from Equation 3 into Equation 4. Third, with $\lambda_2 = 0$, Equation 7c results from plugging the value of λ_1 from Equation 3 into Equation 5.

PROOF. Let Δ denote the determinant of the coefficient matrix of System 8. For stability, it is assumed that $\Delta < 0$. An application of Cramer's rule on System 8 leads to

$$dn/dL = 0,$$

$$\frac{dm}{dL} = \frac{\partial V_2}{\partial n}\left(\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial L} - \frac{\partial V_1}{\partial L}\frac{\partial V_3}{\partial l}\right)\Big/\Delta. \tag{9}$$

Partial differentiation of Equations 7a and 7c leads to

$$\begin{aligned}\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial L} - \frac{\partial V_1}{\partial L}\frac{\partial V_3}{\partial l} &= \frac{-[(m+n)-1]}{L-l}\frac{l^{s+1}(c^n n^s + m)(c^n n^s + m + \Omega l^{-s})}{\Omega(L-l)} \\ &\quad + \frac{(c^n n^s + m)l^s[(s+1)(c^n n^s + m) + \Omega l^{-s}]}{\Omega(L-l)} \\ &= \frac{(c^n n^s + m)l^s[(s+1)(c^n n^s + m) + \Omega l^{-s}]}{\Omega(L-l)} \\ &\quad - \frac{(c^n n^s + m)l^s(c^n n^s + m + \Omega l^{-s})}{\Omega(L-l)} > 0.\end{aligned}$$

If the marginal benefit of establishing one more county increases when the number of counties increases, the mixed form will not be stable. For the mixed form to be stable, the marginal benefit of establishing one more county needs to decrease when the number of counties increases. Because the marginal benefit of establishing one more county is $c^n n^{s-1}(s + n \ln c)$, the stability of the mixed form requires that $\partial V_2/\partial n < 0$. With $\Delta < 0$, from Equation 9, it is clear that $dm/dL > 0$.

To understand Proposition 1, from Equation 7b, the number of counties under the mixed form is determined by the level of coordination efficiency and the degree of increasing returns in the military sector. Thus, a change in the size of the population does not change the number of counties. The expected payoff of the ruler is like a quasilinear utility function if the numbers of the two types of divisions are interpreted as the consumption of two goods. Equation 7b shows the relative marginal utility of having one more county (which is $c^n n^{s-1}[s + n \ln c]$) with that of having one more kingdom (which is 1). An increase in the size of the population is similar to an increase in income, and this additional income is spent on the consumption of the good with relative constant marginal utility (kingdom).

From Proposition 1, when the size of the population increases, because the total number of divisions increases, the possibility of internal rebellions decreases. Because both the number of divisions and the size of the population increase, whether the size of each division increases or not is unclear.

The following proposition studies the effect of an increase in the magnitude of external threats on the ruler's choice of organizational form.

PROPOSITION 2. When the ruler chooses the mixed form, an increase in the magnitude of the external threats leaves the number of counties unchanged, decreases the number of kingdoms, and increases the size of each division.

PROOF. An application of Cramer's rule on System 8 leads to

$$\frac{dn}{d\Omega} = 0,$$

$$\frac{dm}{d\Omega}=\left(\frac{\partial V_1}{\partial l}\frac{\partial V_2}{\partial n}\frac{\partial V_3}{\partial \Omega}\right)\Big/\Delta<0,$$

$$\frac{dl}{d\Omega}=-\left(\frac{\partial V_1}{\partial m}\frac{\partial V_2}{\partial n}\frac{\partial V_3}{\partial \Omega}\right)\Big/\Delta>0.$$

To understand Proposition 2, from Equation 7b, the number of counties under the mixed form does not change with the magnitude of external threats. When the magnitude of external threats increases, the marginal benefit of having a larger division increases. As a result, the size of each division increases. Because the size of each division increases and the size of the population is fixed, the total number of divisions decreases.

The following proposition studies the effect of an increase in the level of coordination efficiency on the ruler's choice of organizational form.

PROPOSITION 3. When the ruler chooses the mixed form, an increase in the level of coordination efficiency increases the number of counties.

PROOF. An application of Cramer's rule to System 8 leads to

$$\frac{dn}{dc}=\frac{\partial V_2}{\partial c}\left(\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial m}-\frac{\partial V_1}{\partial m}\frac{\partial V_3}{\partial l}\right)\Big/\Delta. \tag{10}$$

Partial differentiation of Equations 7a and 7c leads to

$$\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial m}-\frac{\partial V_1}{\partial m}\frac{\partial V_3}{\partial l}<0. \tag{11}$$

From Equation 10 and Inequality 11, it is clear that $dn/dc > 0$.

The following proposition studies the effect of an increase in the degree of returns in the military sector on the ruler's choice of organizational form.

PROPOSITION 4. When the ruler chooses the mixed form, an increase in the degree of returns increases the number of counties.

PROOF. An application of Cramer's rule on System 8 leads to

$$\frac{dn}{ds}=\frac{\partial V_2}{\partial s}\left(\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial m}-\frac{\partial V_1}{\partial m}\frac{\partial V_3}{\partial l}\right)\Big/\Delta. \tag{12}$$

Partial differentiation of Equations 7a and 7c leads to

$$\begin{aligned}\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial m}-\frac{\partial V_1}{\partial m}\frac{\partial V_3}{\partial l}=&-(s-1)(m+n)-\frac{l^{s+2}(c^n n^s+m)(c^n n^s+m+\Omega l^{-s})}{\Omega(L-l)^2}\\&-\frac{(c^n n^s+m)\left[l^{s+1}(c^n n^s+m)(s+1)+\Omega l\right]}{\Omega(L-l)}\\&+\frac{l^{s+1}(m+n)(c^n n^s+m+c^n n^s+m+\Omega l^{-s})}{\Omega(L-l)}.\end{aligned}$$

Because

$$-\frac{(c^n n^s+m)\left[l^{s+1}(c^n n^s+m)(s+1)+\Omega l\right]}{\Omega(L-l)}+\frac{l^{s+1}(m+n)(c^n n^s+m+c^n n^s+m+\Omega l^{-s})}{\Omega(L-l)}<0,$$

it is clear that

$$\frac{\partial V_1}{\partial l}\frac{\partial V_3}{\partial m}-\frac{\partial V_1}{\partial m}\frac{\partial V_3}{\partial l}<0. \tag{13}$$

From Equation 12 and Inequality 13, it is clear that $dn/ds > 0$.

The County Form

In this subsection, I study the corner solution in which the ruler establishes only counties in equilibrium. Under this pure county form, $m = 0$.

From Equations 4 and 5, the number of counties under the county system is defined by

$$c^n L^s+\Omega+(n^2-n)\Omega \ln c=0. \tag{14}$$

Equation 14 has four implications. When the government is organized in the county form, first, an increase in the size of the population increases the optimal number of counties. Second, an increase in the magnitude of external threats decreases the optimal number of counties. Third, an increase in the level of coordination efficiency increases the optimal number of counties. Fourth, an increase in the degree of returns in the military sector increases the optimal number of counties.

For historical evidence, Skinner (1977, pp. 19–22) argues that the number of counties did not grow in two millennia despite long-time population growth. More specifically, he shows that the number of counties was 1180 in the Han Dynasty, 1255 in the Sui Dynasty, 1235 in the Tang Dynasty, 1230 in the Song Dynasty, 1115 in the Yuan Dynasty (1271–1368), 1385 in the Ming Dynasty, and 1360 in the Qing Dynasty.[25] A county had a population of 50,000 in later Han but a population of 300,000 in late Qing. To explain why the number of counties did not increase with the size of the total population in the country, Skinner argues that the coordination efficiency of the government would decrease once the total size of the government bureaucracy was sufficiently large.[26] A lower coordination efficiency decreases and a higher population increases the optimal number of counties. If the effect from a decreased

[25] Those dynasties did not always have the county form. For Han, Ming, and Qing, kingdoms with territories were established during the beginning of dynasties.

[26] Skinner conjectures that dynasties initially tried to maintain the same level of administrative intensity per capita as its predecessor and then were forced by bureaucratic problems within the augmented field administration to retrench to a level suitable to an expanded territory and larger population. For example, the 1550 counties of early Tang were reduced to 1235 by 713, and the 1510 units of early Qing were reduced to 1360 by 1730. Skinner further argues that if constraints of organizational scale were the operative factor, repeatedly frustrating the ruler's desire to maintain earlier levels of governmental effectiveness and administrative intensity at the local level, then the number of county-level units in the various coexisting empires would exceed the levels obtained during the universal empires. He then provides one case to support his argument. During the 6th century, China was divided among three kingdoms: Chen (557–589), Northern Zhou (557–581), and Northern Qi (550–577). The total number of county-level units in the three kingdoms was approximately 2300. After the reorganization of 605 in the unified Sui Dynasty, the total number of counties decreased significantly to 1255.

coordination efficiency cancels with the effect from an increased population, the optimal number of counties would not change.

Parameters Affecting Equilibrium Organizational Form

In this subsection, I discuss the effect of a change in population size, the magnitude of external threats, the level of coordination efficiency, and the degree of returns in the military sector on the ruler's equilibrium choice of organizational form.

Because a kingdom has the same population size as a county, the choice of organizational form depends on a comparison of the marginal benefit of establishing one more kingdom and the marginal benefit of establishing one more county. First, when the marginal benefit of establishing one more kingdom is greater than the marginal benefit of establishing one more county, the number of counties will be zero. From Equations 3 and 4, the number of counties is zero if $c^n n^{s-1}(s + n \ln c) < 1$. Second, when the marginal benefit of establishing one more kingdom is equal to the marginal benefit of establishing one more county, or

$$c^n n^{s-1}(s+n\ln c)=1, \tag{15}$$

the mixed organizational form will be adopted. Third, when the marginal benefit of establishing one more kingdom is less than the marginal benefit of establishing one more county, the number of kingdoms will be zero. From Equations 3 and 4, the number of kingdoms will be zero if

$$c^n n^{s-1}(s+n\ln c)>1, \tag{16}$$

where n is defined in Equation 14. In Inequality 16, because the value of n depends on the value of c, whether Equation 14 is valid or not ultimately depends on the values of c and s. From Equation 14 and Inequality 16, it is clear that when c is large or when s is large, Equation 14 is more likely to be valid. Thus, when the level of coordination efficiency is high or the degree of returns to the military sector is high, the ruler will choose the county form.

First, for an increase in population size, from Proposition 1, if the current organizational form is the mixed form, it will not switch to a different organizational form. Second, for an increase in the magnitude of the level of external threats, from Proposition 2, if the current organizational form is the mixed form, it will not switch to a different organizational form. Third, for an increase in the level of coordination efficiency, from Proposition 3, if the current organizational form is the mixed form, it could switch to the county organizational form if the increase in the level of coordination efficiency satisfies Inequality 16. Finally, for an increase in the degree of returns to the military sector, from Proposition 4, if the current organizational form is the mixed form, it could switch to the county organizational form if the increase in the degree of returns satisfies Inequality 16. Those results are supported by the numerical results in the next section.

5. Numerical Results

In this section, I present the results of the effect of a change in the four exogenous parameters—the size of the population, magnitude of external threats, level of coordination

efficiency, and degree of increasing returns on a ruler's choice of organizational form—by solving Equations 6, 7a–c, and 14 and then calculating the payoff in Equation 2 numerically. For Tables 1–4, the first row of a table is the parameter to be changed, the second row is the payoff to the ruler if the feudalism organizational form is adopted, the third row is the payoff to the ruler if the mixed organizational form is adopted, the fourth row is the payoff to the ruler if the county organizational form is adopted, and the fifth row is the optimal organizational form (for some sets of parameter values, two organizational forms have the same payoff if the precision level of the payoff is four digits after the decimal point). With the specification of the expected payoff to the ruler in Equation 2, it is clear that the expected payoff is always between 0 and 1.

In Table 1, I calculate the effect of a change in population size on the ruler's optimal choice of organizational form. For Table 1, $\Omega = 30$, $c = 0.95$, and $s = 1.2$, and the size of the population changes from 92 to 108. From Table 1, for this set of parameter values, the mixed organizational form is optimal regardless of the size of the population.

In Table 2, I calculate the effect of a change in the magnitude of external threats on the ruler's optimal choice of organizational form. For Table 2, $L = 100$, $c = 0.95$, and $s = 1.2$, and the magnitude of external threats changes from 22 to 38. From Table 2, for this set of parameter values, the mixed organizational form is optimal regardless of the size of the population.

In Table 3, I calculate the effect of a change in the level of coordination efficiency on the ruler's optimal choice of organizational form. For Table 3, $L = 100$, $\Omega = 30$, and $s = 1.2$, and the level of coordination efficiency changes from 0.91 to 0.99. From Table 3, when the level of coordination efficiency increases, first the feudalism organizational form is optimal, then the mixed organizational form is optimal, and finally the county organizational form is optimal.

In Table 4, I calculate the effect of a change in the degree of increasing returns to the military sector on the ruler's optimal choice of organizational form. For Table 4, $L = 100$, $\Omega = 30$, and $c = 0.95$, and the degree of returns to the military sector changes from 1.1 to 1.9. From Table 4, when the degree of increasing returns to the military sector increases, first the feudalism organizational form is optimal, then the mixed organizational form is optimal, and finally the county organizational form is optimal.

6. Government Organizational Forms in Ancient China

A casual observation of China's history leads to the following impression of the historical choice of government organizational form in ancient China. First, the feudalism form died with the Zhou Dynasty more than 2000 years ago. Second, the mixed form was used in different periods of China with different levels of population. The mixed organizational form could be used when the founding emperor of a dynasty hoped to combine the strengths of the county form and the feudalism form in the following sense: Counties guarantee the power of the central government and kingdoms ruled by relatives of the royal family deter powerful ministers from usurping power. In reality, for the Western Jin Dynasty, which adopted the mixed form, the central government became fatally weak and the dynasty ended in 316 after the rebellion by the eight kings was put down in 306. For the Han Dynasty and the Ming Dynasty, which adopted the mixed form in the early periods of the dynasties, after the rebellions by kings

Table 1. Effect of a Change in Population Size

L	92	94	96	98	100	102	104	106	108
Feudalism	0.7672	0.7712	0.7750	0.7788	0.7823	0.7858	0.7892	0.7925	0.7956
Mixed	0.7693	0.7732	0.7770	0.7806	0.7842	0.7876	0.7909	0.7941	0.7972
County	0.7379	0.7414	0.7448	0.7481	0.7513	0.7544	0.7574	0.7603	0.7631
Optimum	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed

Table 2. Effect of a Change in the Magnitude of External Threats

Ω	22	24	26	28	30	32	34	36	38
Feudalism	0.8244	0.8133	0.8026	0.7923	0.7823	0.7727	0.7633	0.7542	0.7454
Mixed	0.8257	0.8147	0.8042	0.7940	0.7842	0.7746	0.7654	0.7565	0.7478
County	0.7879	0.7785	0.7692	0.7602	0.7513	0.7427	0.7343	0.7260	0.7180
Optimum	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed

Table 3. Effect of a Change in Coordination Efficiency

C	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99
Feudalism	0.7823	0.7823	0.7823	0.7823	0.7823	0.7823	0.7823	0.7823	0.7823
Mixed	0.7819	0.7820	0.7824	0.7830	0.7842	0.7865	0.7918	0.8061	0.7820
County	0.6979	0.7101	0.7230	0.7367	0.7513	0.7674	0.7852	0.8061	0.8325
Optimum	Feudalism	Feudalism	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed, county	County

Table 4. Effect of a Change in the Degree of Increasing Returns to the Military Sector

s	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Feudalism	0.7657	0.7823	0.8018	0.8207	0.8378	0.8530	0.8662	0.8777	0.8876
Mixed	0.7655	0.7842	0.8131	0.8472	0.8782	0.8522	0.8654	0.8769	0.8869
County	0.6840	0.7513	0.8049	0.8465	0.8782	0.9024	0.9207	0.9348	0.9457
Optimum	Feudalism	Mixed	Mixed	Mixed	Mixed, county	County	County	County	County

were put down, the rulers switched to the county form. Overall, the mixed form was historically unstable;[27] it had a tendency to degenerate to the county form.[28] Third, the county form was the most common form of government organization since the Qin Dynasty 2000 years ago.

How do the results in this model fit with historical evidence? It is not easy to answer this question, and here I provide some rudimentary discussions of the effects of the four parameters, such as the size of the population on the historical choice of organizational form. First, China's population had a long-run trend of increase (Chao 1986, p. 41). An increase in population size might lead to disappearance of the feudalism form, but through a channel not addressed in this model. Historically, an increase in population in the Zhou Dynasty meant land became scarcer, and conflicts among the borders of the kingdoms increased significantly. The fight among kingdoms led to the demise of the Zhou Dynasty and the feudalism form. The effect of population size on the choice between the mixed form and the county form was not clear-cut: The mixed organizational form appeared in different dynasties with significantly different sizes of population.

Second, historically, an increase in the magnitude of external threats did not lead to the dominance of either the county form or the mixed organizational form. On the one hand, in the Han Dynasty, the emperor Liu Che eliminated the kingdoms established by his ancestors so that he could concentrate resources to deal with the external threats from Xiongnu. On the other hand, in the Ming Dynasty, because the emperor Zhu Yuanzhang did not trust his generals in leading the armies, he established kingdoms for his sons (Zhu Di was one of the sons of Zhu Yuanzhang) to deal with the external threats.

Third, factors such as improvements in the transportation sector might have increased coordination efficiency historically and might also have contributed to the demise of the feudalism form in China and the popularity of the county form.

Finally, the degree of increasing returns to the military sector might have increased historically, at least for some periods of time. Huang (1997, p. 22) argues that army sizes increased significantly in the Zhou Dynasty. Fairbank and Goldman (1992, p. 54) argue that the use of iron led to larger armies. Parker (1996) discusses factors leading to larger armies in Europe, and some factors he discussed, such as the existence of walled cities, were also relevant to ancient China. An increase in the degree of returns in the military sector might also have contributed to the demise of the feudalism form and the popularity of the county form.

7. Conclusion

In this article, I have studied with a simple model how the trade-off between preventing internal rebellions and dealing with external threats in the choice of government organizational form in ancient China could be affected by the size of the population, the level of coordination efficiency, and the degree of increasing returns in the military sector. I have established the following results. First, when the degree of increasing returns in the military sector is high or

[27] This is not strange because the existence of the mixed form requires that parameters together make Equation 15 be satisfied exactly. The satisfaction of Equation 15 is more a coincidence than a norm.

[28] For the Qing Dynasty, which established kingdoms to reward surrounded generals from the Ming Dynasty, after the rebellions of those generals were put down, the land formally controlled by those generals came to be ruled by the central government directly.

when the level of coordination efficiency is high, counties are more likely to be established than kingdoms. Second, under a mixed organizational form, an increase in the size of the population leaves the number of counties unchanged while increasing the number of kingdoms. An increase in the magnitude of external threats leaves the number of counties unchanged while decreasing the number of kingdoms and increasing the size of each division. Finally, a robust feature of the model is that when the magnitude of the external threats increases, regardless of the type of equilibrium organizational form, the equilibrium number of divisions decreases and thus the degree of the concentration of power among division heads increases.

Compared with China's long and splendid history, the level of theoretical research on its ancient history is quite limited. In this article, I show that there are some important issues in China's history that could be analyzed with the use of formal models. There are several interesting generalizations and extensions of the model. First, the feudalism form was associated with the Confucianism school, whereas the county form was associated with the Legalism school (Waley 1982). In ancient China, starting from Liu Che in the Han Dynasty, to rule effectively, governments used a combination of ideas from the Confucianism school and the Legalism school. Why was it necessary to combine the Confucianism school and the Legalism school to rule effectively (Zhou, 2011)?

Second, in ancient China, powerful ministers as well as peasants were able to rebel. With the possibility of peasant rebellions, some interesting questions need to be addressed. For example, in the Ming Dynasty, the peasant rebellion of Li Zicheng exacerbated the threats from Manchu. The Ming Dynasty had to fight with Li and Manchu at the same time. Because the Ming Dynasty struggled with fighting on two fronts, it eventually collapsed. Should the Ming government negotiate with one enemy so that it could concentrate on fighting with the other one? If so, which enemy should it negotiate with? What was the acceptable cost of truce?

Finally, the performance of an organizational form was affected by the abilities of the rulers. For example, although the military system introduced by Zhao Kuangyin in the Song Dynasty operated relatively well when he was the emperor, the operation of the system deteriorated in later generations of the Song Dynasty. Historically, the occurrence of internal rebellion was affected by the relative abilities of the ruler and the most capable general. Whereas a founding emperor could be extremely capable, succeeding emperors might have much lower levels of abilities. If the ability of the emperor was low or if the emperor was young, either ambitious generals could engage in military coups or civilian officials could usurp the central government. The evolution of the abilities of emperors in a given dynasty can be modeled as a stochastic process. The model can be generalized to a dynamic setup in which the effect of the uncertainties of the abilities of emperors on the performance of different organizational forms can be addressed explicitly.

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